

# Five new species of *Passaloecus* Shuckard (Hymenoptera, Crabronidae) from China, with a key to Chinese species

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## Abstract

Based on the key diagnostic characteristics such as petiole, clypeus, and hypersternaulus, five new species of *Passaloecus* from China are identified: *P. clypearcuatus* Li & Ma, **sp. nov.**, *P. clypeconvexus* Li & Ma, **sp. nov.** *P. edentatus* Li & Ma, **sp. nov.**, *P. margdentatus* Li & Ma, **sp. nov.**, and *P. sternoleios* Li & Ma, **sp. nov.**. Detailed descriptions, diagnoses, and photographs of diagnostic characteristics are provided for these new species. Additionally, a key to the known species of *Passaloecus* in China is updated and illustrated, further enhancing the understanding of biodiversity within this genus.

## Keywords

Digger wasps, identification key, morphology, Pemphredoninae, taxonomy

## Introduction

In 1837, Shuckard placed *Pemphredon insignis* within the genus *Passaloecus*, establishing *Passaloecus* as a new taxon and designating *Passaloecus insignis* (Vander Linden, 1829) as its type species (Shuckard 1837). The classification system used in this study integrates research findings from Pulawski (2024) incorporating the studies of Brothers (1999) and Melo (1999). *Passaloecus* belongs to Hymenoptera:

Crabronidae: Pemphredoninae: Pemphredonini: Pemphredonina. The main diagnostic characteristics of Pemphredonina include the presence of two submarginal cells and three discal cells on the forewing (Kim and Yang 2010). The Pemphredonina comprises four genera, with *Passaloecus* resembling *Polemistus* and *Pemphredon* resembling *Diodontus*. *Passaloecus* can be readily distinguished from *Pemphredon* and *Diodontus* by the following characteristics: episternal sulcus well-developed, distinctly crenate; mesopleuron nearly smooth, lacking complex characteristics; mandible apex with 2–3 teeth; females without pygidial plate. The difference between *Passaloecus* and its closely related genus *Polemistus* lies in the following characteristics: inner orbits nearly parallel, with less pronounced aggregation in the lower frons; gena without long, erect setae ventrally; mesopleuron often without omaulus (Yasumatsu 1934; Bohart and Menke 1976). *Passaloecus* are small (4–9 mm) predatory wasps that primarily feed on aphids. Females of this genus nest in existing cavities, such as tree stems previously excavated by other insects, old galls, or by excavating their own burrows in soft, pithy wood. The cells within the nest are separated by resin and arranged linearly (Finnimore 1982; Antropov and Perkovsky 2009; Kaplan and Yildirim 2023). Based on our field collection experience, species of this genus are commonly found in environments such as wooden houses, dead wood, and nature reserves. These locations provide abundant wood resources and suitable nesting habitats, fulfilling their nesting and predation needs.

*Passaloecus* is represented by 46 species and five subspecies worldwide, with the majority of species distributed in the Palearctic region (30 species and three subspecies) and the Nearctic region (19 species and one subspecies). The Oriental region has a relatively lower diversity, with 13 species and one subspecies, while only one species occurs in the Neotropical region (Tsuneki 1955, 1967, 1974; Vincent 1979; Amarante and Vincent 1993; Vardy 2017; Kejval et al. 2020; Shorenko 2020; Saure 2021; Pulawski 2024). Scholars such as Qiang Li, Li Ma, and Bashir have conducted extensive diversity and taxonomic studies on Chinese Pemphredoninae, describing and documenting numerous new species and records. Their research has increased the known diversity of *Passaloecus* in China to 18 species and one subspecies (Ma and Li 2012; Ma et al. 2013, 2018; Bashir et al. 2019, 2020, 2021, 2023).

This study provides detailed descriptions and illustrations of five new species from China: *P. clypearcuatus* sp. nov., *P. clypeconvexus* sp. nov., *P. edentutus* sp. nov., *P. margdentatus* sp. nov., and *P. sternoleios* sp. nov. Additionally, an illustrated key to all known *Passaloecus* species in China is provided.

## Materials and methods

The specimens examined in this study were collected using malaise traps, yellow plates, sweep nets, and flight intercept traps, and were deposited in the Insect Collections of Yunnan Agricultural University, Kunming, Yunnan, China (YNAU). Observations were conducted under an Olympus stereomicroscope (SZ Series) with an ocular

micrometer. Measurements were taken at 5 $\times$  magnification, except for body length, which was measured at 2 $\times$  magnification and subsequently converted. Photographs were captured using a VHX-5000 and edited with Adobe Photoshop 8.0. Morphological terminology follows Bohart and Menke (1976), Vincent (1979), and Bashir et al. (2023). The description of the five new species is based on holotypes. The abbreviations and definitions used are as follows:

<b>AOD</b>	Distance from inner eye margin to antennal socket, frontal view;
<b>BL</b>	Body length;
<b>EDL</b>	Distance between inner eye margins at base of clypeus, frontal view;
<b>EDU</b>	Distance between inner eye margins at base of vertex, dorsally;
<b>EL</b>	Eye length in lateral view, maximum;
<b>EW</b>	Eye width in lateral view, maximum;
<b>EWd</b>	Eye width in frontal view, maximum;
<b>HLD</b>	Head length in dorsal view, the distance from occipital margin to frons, medially;
<b>HLF</b>	Head length in front view, the distance from the clypeal margin to the vertex, medially;
<b>HW</b>	Head width, dorsally;
<b>IAD</b>	Distance between antennal sockets, frontal view;
<b>LFI</b>	Length of flagellomere I;
<b>LFII</b>	Length of flagellomere II;
<b>LTI</b>	Length of gastral tergum I, maximum, dorsally;
<b>OCD</b>	Ocello-occipital distance, distance between posterior margin of hind ocellus and occipital margin, dorsally;
<b>OOD</b>	Ocellocular distance, distance between outer margin of hind ocellus and nearest inner orbit, dorsally;
<b>PL</b>	Pedicel length;
<b>PLL</b>	Petiole length laterally, maximum;
<b>POD</b>	Postocellar distance, distance between inner margins of hind ocelli, dorsally;
<b>PW</b>	Petiole width, maximum, dorsally;
<b>SL</b>	Scape length;
<b>TW</b>	Gena width in lateral view, maximum;
<b>WAS</b>	Width of antennal socket, frontal view;
<b>WFI</b>	Width of flagellomere I;
<b>WFII</b>	Width of flagellomere II;
<b>WTI</b>	Width of gastral tergum I, maximum, dorsally.

## Taxonomy

### Genus *Passaloecus* Shuckard, 1837

**Type species.** *Pemphredon insignis* Vander Linden, 1829.

## Key to the species of *Passaloecus* from China, including males and females

Females of *P. multituberculatus* Ma & Li, *P. petiolatus* Ma & Li and *P. tuberculiformis* Bashir & Ma and males of *P. frontirugatus* Bashir & Ma, *P. labrinigratus* Ma & Li, *P. monilicornis taiwanus* Tsuneki, *P. clypearcuatus* sp. nov., *P. clypeconvexus* sp. nov., *P. edentatus* sp. nov., *P. margdentatus* sp. nov., and *P. sternoleios* sp. nov. remain unknown.

- 1 Clypeus deeply concave, free margin not produced (Fig. 1A) .... *P. clypearcuatus* Li & Ma, sp. nov.
- Clypeus flat or raised, free margin slightly or broadly produced (Fig. 2A) ..... 2
- 2 Mandible tridentate apically ..... 3
- Mandible bidentate apically (Fig. 2A) ..... 5
- 3 Interantennal tubercle narrow and short; free margin of clypeus toothless, females truncate, males nearly arcuate..... *P. profundesulcatus* Bashir & Ma
- Interantennal tubercle robust, forming columned or conical projection; free margin of clypeus with three small teeth ..... 4
- 4 Pronotal collar without anterior, transverse carina and antero-lateral corner; posterior area of mesopleuron smooth, without rugae; hypersternaulus shallow, short, inconspicuously crenate; gaster distinctly constricted between terga I and II..... *P. columnaris* Ma & Li
- Pronotal collar with robust, anterior, transverse carina, antero-lateral corner slightly produced; posterior area of mesopleuron with dense, short, longitudinal rugae; hypersternaulus deep, normal length, distinctly crenate; gaster slightly constricted between terga I and II..... *P. corniger* Shuckard
- 5 Petiole slightly to distinctly longer than wide (Fig. 3F) ..... 6
- Petiole not longer than wide (Fig. 2F) ..... 11
- 6 Hypersternaulus smooth, not crenate (Fig. 4D) ..... 7
- Hypersternaulus distinctly crenate (Fig. 5D) ..... 8
- 7 Free margin of clypeus slightly produced, with three distinct, conical teeth medially (Fig. 4A); posterior area of mesopleuron smooth, without rugae (Fig. 4D); scrobal suture broad, shallow, slightly crenate (Fig. 4D); labrum hardly constricted subapically; pronotal lobe black (Fig. 4D) .....
- *P. margdentatus* Li & Ma, sp. nov.
- Free margin of clypeus broadly produced, with distinct emargination medially (Fig. 3A); posterior area of mesopleuron with sparse, indistinct, short, longitudinal rugae (Fig. 3D); scrobal suture vestigial, only with single trace (Fig. 3D); labrum distinctly constricted subapically; pronotal lobe ivory (Fig. 3D)..... *P. edentatus* Li & Ma, sp. nov.

- 8 Inner orbital furrow broad, smooth, and with conspicuous, inner marginal carina (Fig. 5A), outer orbital furrow broad, conspicuously crenate, and with conspicuous, hind marginal carina (Fig. 5H); occipital carina broad, conspicuously crenate (Fig. 5B); notaulus absent (Fig. 5C); sternum I smooth, without rugae (Fig. 5G) ..... *P. sternoleios* Li & Ma, sp. nov.
- Inner and outer orbital furrows lacking; occipital carina narrow, not crenate; notaulus slightly or distinctly impressed; sternum I with several, short, longitudinal rugae ..... 9
- 9 Lateral surface of propodeum with dense, slender, oblique rugae anteriorly; sternum I in anterior half with slender, median, longitudinal carina; gaster not constricted between terga I and II ..... *P. birugatus* Bashir & Chen
- Lateral surface of propodeum smooth, without rugae anteriorly; sternum I without median, longitudinal carina; gaster slightly or distinctly constricted between terga I and II ..... 10
- 10 Admedian line slightly impressed; gaster distinctly constricted between terga I and II; gena with dense, fine punctures ventrally; clypeus with dense, mid-size punctures ..... *P. petiolatus* Ma & Li
- Admedian line distinctly impressed; gaster slightly constricted between terga I and II; ventral gena with sparse, fine punctures; clypeus with sparse, fine punctures ..... *P. tuberangustus* Bashir & Ma
- 11 Scrobal suture distinct, weakly to distinctly crenate (Fig. 2D) ..... 12
- Scrobal suture absent or weakly impressed, not crenate ..... 16
- 12 Omaulus present; ocellar triangle flat ..... *P. turionum* Dahlbom
- Omaulus absent (Fig. 2D); ocellar triangle slightly convex (Fig. 2B) ..... 13
- 13 Antero-lateral corner markedly produced; hypersternaulus and episternal sulcus distinctly broadened; frontal median carina absent ..... 14
- Antero-lateral corner absent (Fig. 2C); hypersternaulus and episternal sulcus of normal width (Fig. 2D); frontal median carina distinct (Fig. 2A) ..... 15
- 14 Females with scutal patches; interantennal tubercle reduced to one point; labrum slightly constricted subapically; pronotal lobe black ..... *P. labrinigratus* Ma & Li
- Females without scutal patches; interantennal tubercle distinct, slightly elongated; labrum distinctly constricted subapically; pronotal lobe yellow ..... *P. frontirugatus* Bashir & Ma
- 15 Occipital carina distinctly crenate; labrum distinctly constricted subapically; anterior part of scutum normal; scutum with sparse, short, longitudinal rugae posteriorly ..... *P. bisulcatus* Bashir & Ma
- Occipital carina not crenate (Fig. 2B); labrum not constricted subapically; anterior part of scutum nearly right angle, significantly higher than pronotum (Fig. 2C); scutum smooth, without rugae posteriorly (Fig. 2C) ..... *P. clypeconvexus* Li & Ma, sp. nov.

- 16 Anterior part of scutum normal ..... 17  
— Anterior part of scutum nearly right angle, significantly higher than pronotum ..... 18
- 17 Clypeus distinctly convex medially; lateral surface of propodeum with dense, slender, oblique rugae anteriorly; antero-lateral corner moderately to distinctly produced; pronotal lobe white; in females, head from above with temples distinctly convergent posteriorly ..... *P. clypealis* Faester  
— Clypeus nearly flat medially; lateral surface of propodeum smooth anteriorly; antero-lateral corner absent; pronotal lobe brown to black; in females, head from above with temples slightly convergent posteriorly ..... *P. singularis* Dahlbom
- 18 Females with scutal patches; in males, posterior area of tergum VI without spinose tubercles ..... *P. turanicus* Gussakovskij  
— Females without scutal patches; in males, posterior area of tergum VI with conspicuous spinose tubercles ..... 19
- 19 Propodeal enclosure and posterior surface of propodeum irregularly reticulated ..... 20  
— Propodeal enclosure with irregular rugae or reticulation medially, and with sparse or dense, oblique rugae on each side; posterior surface of propodeum with irregular rugae ..... 21
- 20 Pronotal collar with robust, anterior, transverse carina, antero-lateral corner markedly produced; occipital carina not crenate; lateral surface of propodeum with dense, slender, irregular, oblique rugae anteriorly, and with sparse, sturdy, oblique rugae posteriorly; body predominantly black ..... *P. multituberculatus* Ma & Li  
— Pronotal collar without anterior, transverse carina or antero-lateral corner; occipital carina distinctly crenate ventrally; lateral surface of propodeum shiny, nearly smooth anteriorly, and with sturdy reticulation posteriorly; body predominantly yellowish-brown to reddish-brown ..... *P. tuberculiformis* Bashir & Ma
- 21 Occipital carina distinctly crenate; parapsidal line weakly impressed; metanotum with sparse, tiny punctures; flagellum mostly yellow ..... *P. koreanus* Tsuneki  
— Occipital carina not crenate; parapsidal line distinctly impressed; metanotum with dense, fine punctures; flagellum dark brown to black ..... 22
- 22 Antero-lateral corner markedly produced; propodeal enclosure reticulated medially; frontal median carina weakly impressed; in male, flagellum normal ..... *P. insignis* (Vander Linden)  
— Antero-lateral corner slightly produced; propodeal enclosure irregularly rugose medially; frontal median carina absent; in male, flagellum slightly moniliform ..... 23
- 23 Pronotal lobe ivory to yellowish ..... *P. monilicornis monilicornis* Dahlbom  
— Pronotal lobe black ..... *P. monilicornis taiwanus* Tsuneki

## Species accounts

### *Passaloecus clypearcuatus* Li & Ma, sp. nov.

<https://zoobank.org/28B30E12-2206-4FA6-8D22-4F71D2DCE5C2>

Figs 1A–G

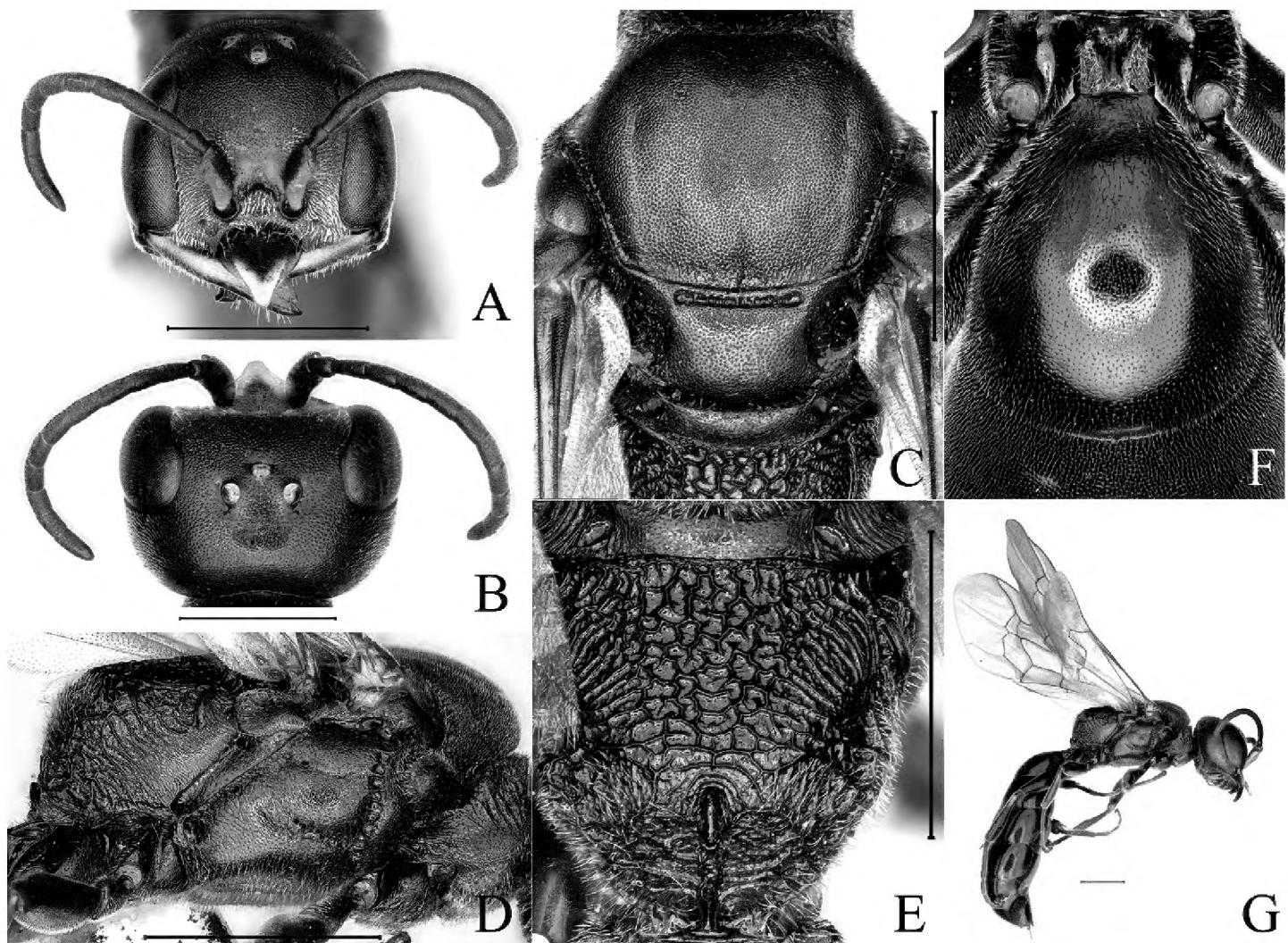
**Type material.** **Holotype:** CHINA • ♀; Yunnan, Shangri-La City, Pudacuo National Park; 27°55'13"N, 99°52'46"E; 3515 m elev.; 16.VII.2022; coll. Zhizhi Liu; sweep net (YNAU). **Paratype:** CHINA • 1♀; Shaanxi, Baoji City, Tiantai Mountain Scenic Area; 34°17'10"N, 107°10'55"E; 852 m elev.; 8–10.VI.1998; NO.983654; coll. Yun Ma; sweep net (YNAU).

**Diagnosis.** This species differs from the similar species *P. labrinigratus* Ma & Li, 2012 and other congeners in the following characteristics: free margin of clypeus with two robust, triangular teeth medially, distinctly reflected, area between two teeth deeply concave; scutal patches absent; scutum with sparse, irregular, short, longitudinal rugae posteriorly; scapal hollow coriaceous, shiny and clearly defined; gaster not constricted between terga I and II. *Passaloecus labrinigratus* has the following characters: free margin of clypeus broadly produced, truncate medially; scutal patches ovate; scutum smooth, without rugae posteriorly; scapal hollow coarsely coriaceous, moderately matte, not clearly defined; gaster slightly constricted between terga I and II.

**Description. Female. Measurements.** ♀, BL: 7.7 mm; HLF: HW: HLD = 63: 80: 51; HW: EWd: EW: TW: EL = 80: 15: 20: 28: 49; POD: OOD: OCD = 13: 13: 23; SL: PL: LFI: LFII: WFI: WFII = 29: 7: 12: 11: 6: 6; WAS: AOD: IAD = 6: 10: 14; EDU: EDL = 47: 49; PLL: PW: LTI: WTI = 10: 13: 55: 48.

**Color pattern.** Body black; mandible inner margin pale yellow, remainder reddish-brown to dark brown; labrum ivory medially, central part dark brown; ventral scape ivory to pale yellow; tegula, palpi and forewing veins dark brown; fore tibia and tarsus dark brown; mid leg: inner margin of femur, tibia, and tarsus pale yellow to yellowish-brown, remainder of femur and trochanter dark brown; basal 1/4 of hind tibia dark brown; clypeus with scattered, silvery, short setae.

**Head.** Mandible bidentate apically, inner tooth large (Fig. 1A). Labrum slightly narrower than clypeal lobe, V-shaped, apex bluntly rounded, slightly constricted subapically (Fig. 1A). Clypeus flat, with sparse, fine punctures, slightly coriaceous; free margin of clypeus with two robust, triangular teeth medially, distinctly reflected, area between two teeth deeply concave (Fig. 1A). Sides of lower frons slightly coriaceous; scapal hollow coriaceous, shallow, clearly defined; interantennal tubercle very short; frontal median carina absent; median and upper frons distinctly coriaceous, with dense, large punctures, sometimes contiguous (Fig. 1A). Ocellar triangle coarsely coriaceous, slightly convex, and with dense, midsize punctures (Fig. 1B). Vertex distinctly coriaceous, with dense, midsize punctures and weakly transverse striations (Fig. 1B). Dorsal gena coarsely coriaceous, with dense, fine to midsize punctures; ventral gena coarsely coriaceous, with midsize punctures. Occipital carina narrow, not crenate (Fig. 1B). Inner and outer orbital furrows lacking (Fig. 1A).



**Figure 1.** *Passaloecus clypearcuatus* Li & Ma, sp. nov. (female) **A** head, frontal view **B** head, dorsal view **C** collar, scutum, scutellum and metanotum, dorsal view **D** thorax, lateral view **E** propodeum, dorsal view **F** petiole and tergum I, dorsal view **G** habitus, lateral view. Scale bars: 1 mm.

**Mesosoma.** Pronotal collar with robust, anterior, transverse carina, antero-lateral corner slightly produced (Fig. 1C). Scutum coarsely coriaceous, with dense, midsize punctures, anterior area nearly right angle, significantly higher than pronotum, posterior area with sparse, irregular, short, longitudinal rugae; scutal patches absent; admedian line distinctly impressed, extending to 1/3 of scutum length; notaulus shallowly impressed, indistinctly crenulate, extending to 1/3 of scutum length; parapsidal line distinct, longer than admedian line (Fig. 1C). Scutellum slightly coriaceous, with dense, midsize punctures (Fig. 1C). Metanotum slightly coriaceous, with dense, fine punctures (Fig. 1C). Mesopleuron coarsely coriaceous, with dense, midsize punctures, posterior area with sparse, very short, longitudinal rugae; scrobal suture deeply impressed, not crenate; hypersternaulus and episternal sulcus distinctly crenate; omaulus absent (Fig. 1D). Metapleuron shiny and smooth (Fig. 1D). Propodeal enclosure not delimited by carina, with irregular rugae medially, and several, robust oblique rugae laterally; posterior surface of propodeum with irregular rugae, interspersed with several, robust, transverse rugae (Fig. 1E); lateral surface of propodeum with dense, slender, irregular, oblique rugae anteriorly, and sparse, robust, oblique rugae posteriorly (Fig. 1D).

**Metasoma.** Petiole short, not longer than width; dorsal surface of petiole with median, longitudinal groove (Fig. 1F); lateral surface of petiole with two short,

longitudinal carinae (Fig. 1G). Gaster moderately matte, slightly coriaceous, with dense, fine punctures (Fig. 1G); sternum I with several, longitudinal rugae; median, longitudinal carina lacking; sternum II deeply impressed basally; gaster not constricted between terga I and II (Fig. 1G); pygidial plate lacking.

**Male.** Unknown.

**Distribution.** China (Yunnan, Shaanxi).

**Etymology.** The name *clypearcuatus* is derived from the Latin *clype-* (= clypeus) and the Latin word *arcuatus* (= arcuate), referring to the area between two teeth on free margin of clypeus with an arcuate, deep concavity.

***Passaloecus clypeconvexus* Li & Ma, sp. nov.**

<https://zoobank.org/A0D16311-C339-4BCC-BD26-219213486496>

Figs 2A–G

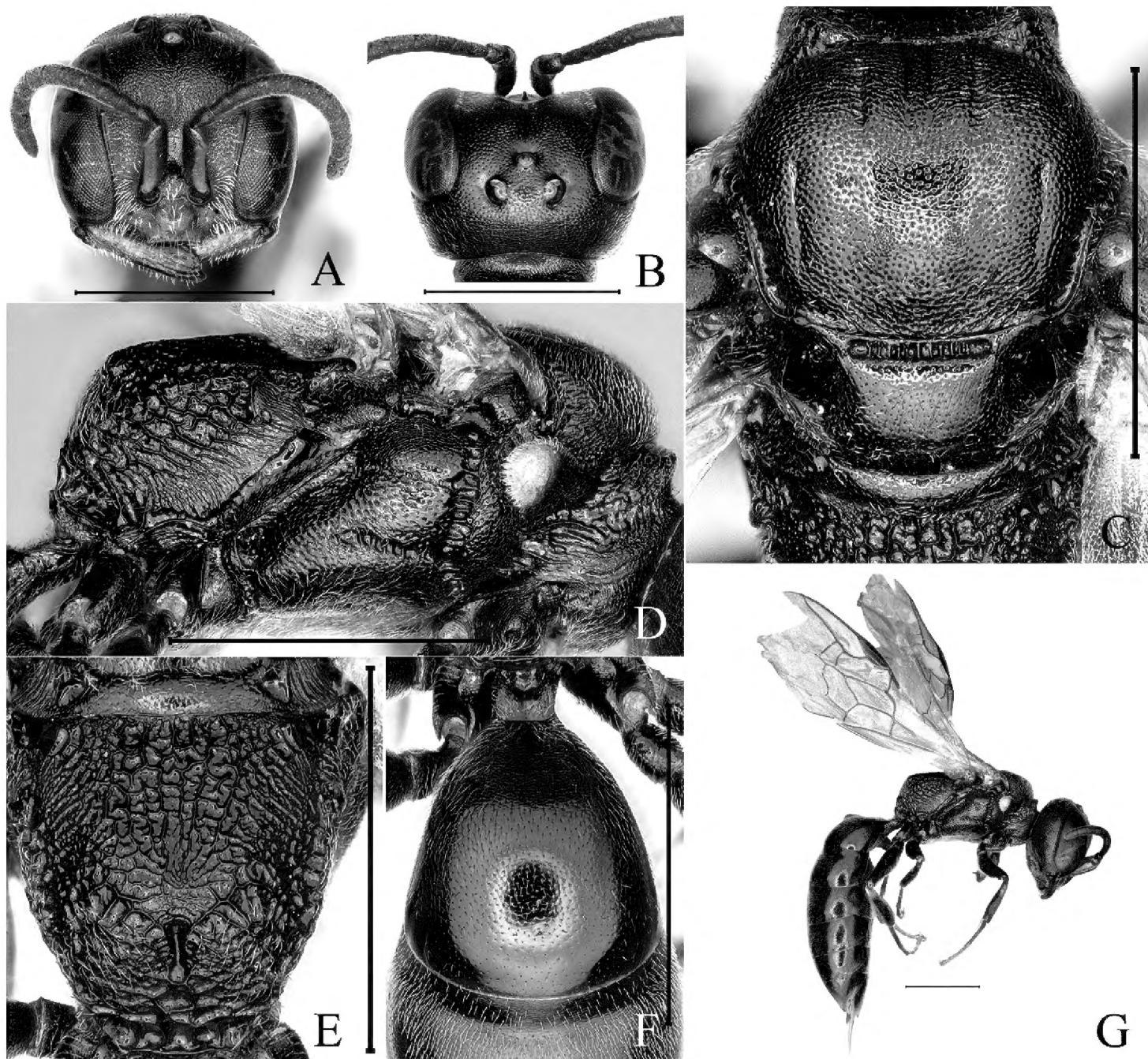
**Type material. Holotype:** CHINA • ♀; Xinjiang, Gongliu County, Qiaxi Forest Park; 43°5'44"N, 82°39'18"E; 1713.8 m elev.; 7.VII.2023; coll. Lili Dong; sweep net (**YNAU**). **Paratype:** CHINA • 1♀; Xinjiang, Gongliu County, Hetaogou Scenic Area; 43°22'59"N, 82°16'10"E; 913 m elev.; 30.VI.2016; coll. Yicheng Li; sweep net (**YNAU**).

**Diagnosis.** This species can be distinguished from the similar species *P. bisulcatus* Bashir & Ma, 2019 and other congeners by: occipital carina not crenate; labrum not constricted subapically; anterior part of scutum nearly right angle, significantly higher than pronotum; scutum smooth, without rugae posteriorly; propodeal enclosure with irregular rugae medially, and with sparse, oblique rugae on each side. *Passaloecus bisulcatus* has the following characters: occipital carina distinctly crenate; labrum distinctly constricted subapically; anterior part of scutum normal; scutum with sparse, short, longitudinal rugae posteriorly; propodeal enclosure with sturdy, irregular reticulation.

**Description. Female. Measurements.** ♀, BL: 5.3 mm; HLF: HW: HLD = 53: 54: 36; HW: EWd: EW: TW: EL = 54: 13: 15: 25: 40; POD: OOD: OCD = 8: 9: 12; SL: PL: LFI: LFII: WFI: WFII = 20: 6: 6: 3: 3; WAS: AOD: IAD = 4: 5: 6; EDU: EDL = 32: 22; PLL: PW: LTI: WTI = 6: 10: 38: 36.

**Color pattern.** Body black; mandible predominantly reddish-brown, basal inner margin grayish-white; palpi and tegula brown to dark brown; scape ventrally and pro-notal lobe ivory; fore and mid tibiae and tarsis brown to dark brown; hind leg: tibia brown, except basal 1/4 ivory, tarsus brown; sides of lower frons and clypeus with scattered, silvery, short setae; outer margin of mandible with several golden, long setae.

**Head.** Mandible bidentate apically, inner tooth large (Fig. 2A). Labrum heart-shaped, not constricted subapically. Clypeus conspicuously convex medially, coriaceous; free margin of clypeus broadly produced, truncate medially; sides of lower frons coarsely coriaceous (Fig. 2A). Scopal hollow coriaceous, shallow, not clearly defined (Fig. 2A). Interantennal tubercle narrow and short; frontal median carina slightly impressed; median and upper frons coarsely coriaceous, slightly convex, with dense, midsize punctures (Fig. 2A). Ocellar triangle shiny, moderately convex, with dense,



**Figure 2.** *Passaloecus clypeconvexus* Li & Ma, sp. nov. (female) **A** head, frontal view **B** head, dorsal view **C** collar, scutum, scutellum and metanotum, dorsal view **D** thorax, lateral view **E** propodeum, dorsal view **F** petiole and tergum I dorsal view **G** habitus, lateral view. Scale bars: 1 mm.

midsize punctures (Fig. 2B). Vertex shiny, coriaceous, with dense, weakly transverse striations (Fig. 2B). Gena shiny, coriaceous and impunctate. Occipital carina narrow, not crenate (Fig. 2B). Inner and outer orbital furrows lacking (Fig. 2A).

**Mesosoma.** Pronotal collar with robust, anterior, transverse carina, antero-lateral corner absent (Fig. 2C). Scutum shiny, with dense, midsize to large punctures, anterior area nearly right angle, significantly higher than pronotum and with sparse, transverse striations; scutal patches nearly ovate, slightly raised; admedian line weakly impressed, extending to 2/7 of scutum length; notaulus distinct and crenulate, slightly longer than admedian line; parapsidal line distinct, long (Fig. 2C). Scutellum shiny, with dense, fine punctures. Metanotum shiny and smooth (Fig. 2C). Mesopleuron shiny, with sparse, midsize punctures, posterior area with contiguous, very short, longitudinal rugae; scrobal suture narrow, shallowly impressed and weakly crenate;

hypersternaulus and episternal sulcus deep, conspicuously crenate; omaulus absent (Fig. 2D). Metapleuron shiny and smooth (Fig. 2D). Propodeal enclosure matte, not delimited by carina, with irregular rugae medially, and irregular, sparse, oblique rugae laterally, area between rugae with contiguous, fine punctures; posterior surface of propodeum coarsely coriaceous, shiny, and with reticulation posteriorly (Fig. 2E); lateral surface of propodeum with dense, slender, oblique rugae anteriorly, and irregular reticulation posteriorly (Fig. 2D).

**Metasoma.** Petiole short, not longer than width (Fig. 2F); dorsal surface of petiole with median, longitudinal groove (Fig. 2F); lateral surface of petiole with two short, longitudinal carinae (Fig. 2G). Gaster shiny, with sparse, tiny punctures; sternum I matte, with several, longitudinal rugae, median, longitudinal carina lacking; sternum II deeply impressed basally; gaster distinctly constricted between terga I and II (Fig. 2G); pygidial plate lacking.

**Male.** Unknown.

**Distribution.** China (Xinjiang).

**Etymology.** The name *clypeconvexus* is derived from the Latin *clype-* (= clypeus) and the Latin word *convexus* (= convex), referring to the clypeus conspicuously convex medially.

### *Passaloecus edentatus* Li & Ma, sp. nov.

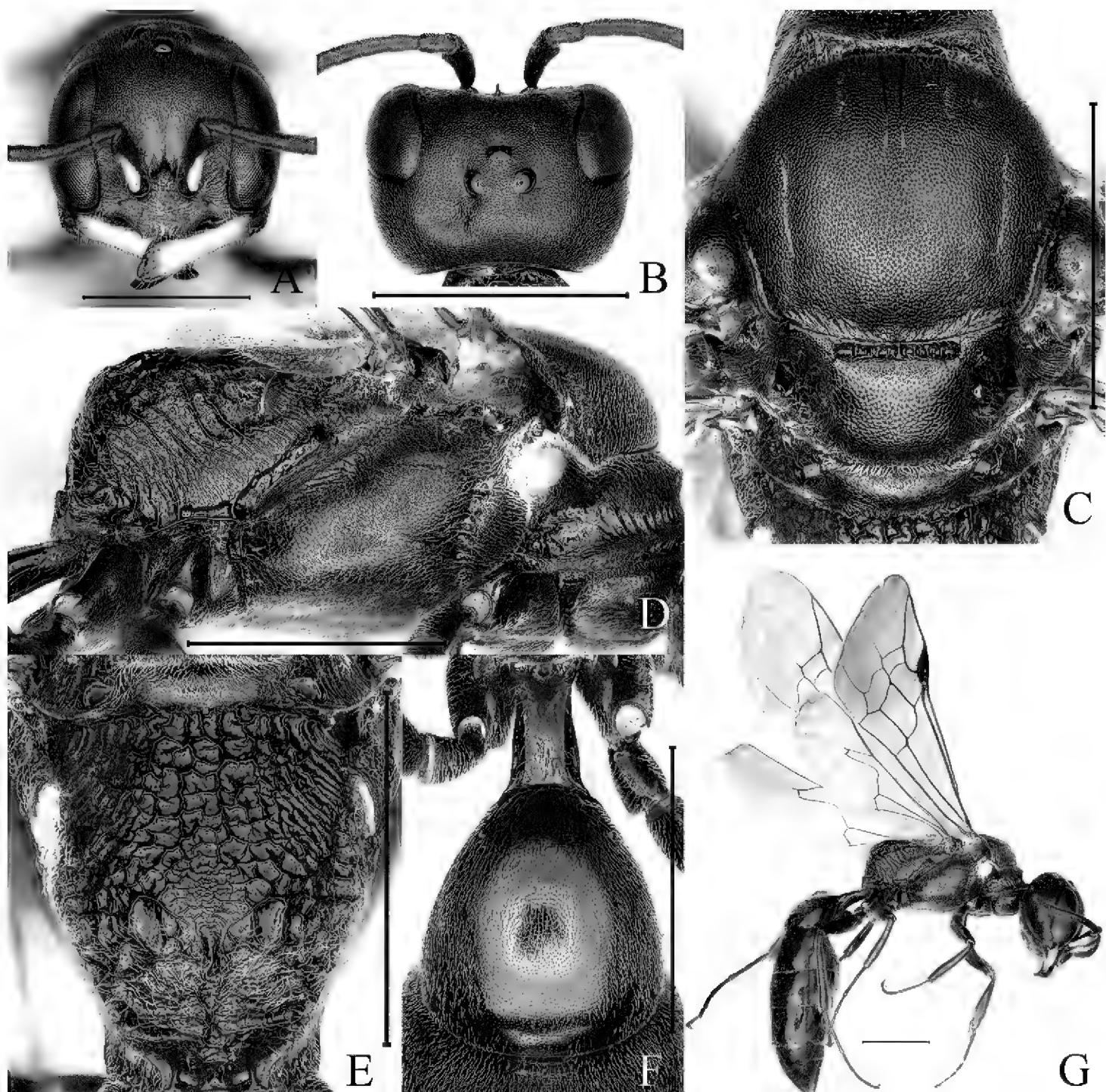
<https://zoobank.org/6F867050-BE09-41CA-A4F9-48D9A725A406>

Figs 3A–G

**Type material.** **Holotype:** CHINA • ♀; Tibet, Shigatse City, Yadong County, Shang Yadong Country, Galingang Village; 27°30'28"N, 88°57'40"E; 3445 m elev.; 24.VII.2018; NO.202006141; coll. Shijie Du; sweep net (YNAU). **Paratype:** CHINA • 1♀; Tibet, Shigatse City, Gyirong County, Gyirong Town, Madun Bridge; 28°23'35"N, 85°19'45"E; 2795 m elev.; 1.VIII.2018; coll. Shijie Du; sweep net (YNAU).

**Diagnosis.** This species differs from *P. tuberangustus* Bashir & Ma, 2019 and other congeners by these characteristics: hypersternaulus smooth, not crenate; pronotal collar with weak, anterior, transverse carina laterally; lateral surface of propodeum with dense, slender, oblique rugae anteriorly; propodeal enclosure with irregular rugae medially, and sparse, irregular, oblique rugae laterally; mesopleuron coriaceous, posterior area with sparse, indistinct, very short, longitudinal rugae. *Passaloecus tuberangustus* has the following characters: hypersternaulus conspicuously crenate; pronotal collar without anterior, transverse carina; lateral surface of propodeum smooth and shiny anteriorly; propodeal enclosure with dense, slender, longitudinal rugae, and interspersed with several, short, transverse rugae medially; mesopleuron coarsely coriaceous, posterior area smooth, without rugae.

**Description. Female. Measurements.** ♀, BL: 6.9 mm; HLF: HW: HLD = 58: 67: 40; HW: EWd: EW: TW: EL = 67: 16: 16: 35: 43; POD: OOD: OCD = 7: 11: 18; SL: PL: LFI: LFII: WFI: WFII = 25: 7: 8: 8: 4: 5; WAS: AOD: IAD = 7: 10: 9; EDU: EDL = 49: 43; PLL: PW: LTI: WTI = 30: 7: 42: 35.



**Figure 3.** *Passaloecus edentatus* Li & Ma, sp. nov. (female) **A** head, frontal view **B** head, dorsal view **C** collar, scutum, scutellum and metanotum, dorsal view **D** thorax, lateral view **E** propodeum, dorsal view **F** petiole and tergum I dorsal view **G** habitus, lateral view. Scale bars: 1 mm.

**Color pattern.** Body black; mandible ivory except apex reddish-brown; palpi ivory to brown; ventral scape and pronotal lobe ivory; tegula and forewing veins dark brown; all tibiae and tarsis brown to dark brown; sides of lower frons and clypeus with scattered, silvery, short setae; outer margin of the mandible with scattered golden, long setae.

**Head.** Mandible bidentate apically, inner tooth large (Fig. 3A). Labrum broadly V-shaped, slightly wider than clypeal lobe, apex bluntly rounded, distinctly constricted subapically (Fig. 3A). Clypeus smooth medially, coriaceous elsewhere; free margin of clypeus broadly produced, distinctly emarginated medially (Fig. 3A). Sides of lower frons coarsely coriaceous; scapal hollow coriaceous, shallow, clearly defined; interantennal tubercle narrow and short; frontal median carina distinct, slightly impressed;

median and upper frons coarsely coriaceous, slightly convex, with dense, fine punctures (Fig. 3A). Ocellar triangle coarsely coriaceous, nearly flat, with dense, fine punctures (Fig. 3B). Vertex coriaceous, with dense, weak, transverse striations (Fig. 3B). Gena coriaceous, shiny, impunctate. Occipital carina narrow, not crenate (Fig. 3B). Inner and outer orbital furrows lacking (Fig. 3A).

**Mesosoma.** Pronotal collar with weak, anterior, transverse carina laterally, without antero-lateral corner (Fig. 3C). Scutum coarsely coriaceous, with dense, fine punctures, anterior area nearly right angle, significantly higher than pronotum, posterior area smooth, without rugae; scutal patches absent; admedian line distinctly impressed, extending to 1/3 of scutum length; notaulus indistinctly impressed, slightly shorter than admedian line; parapsidal line distinctly impressed, long (Fig. 3C). Scutellum and metanotum coriaceous and impunctate (Fig. 3C). Mesopleuron coriaceous, posterior area with sparse, indistinct, very short, longitudinal rugae; scrobal suture reduced to single trace; hypersternaulus narrowly, weakly impressed, smooth and not crenate; episternal sulcus broad, deeply impressed and distinctly crenate; omaulus absent (Fig. 3D). Metapleuron shiny and smooth (Fig. 3D). Propodeal enclosure matte, not delimited by carina, with irregular rugae medially, and sparse, irregular, oblique rugae laterally; posterior surface of propodeum coarsely coriaceous and with sparse, irregular rugae (Fig. 3E); lateral surface of propodeum with dense, slender, oblique rugae anteriorly, and sparse, robust, oblique rugae posteriorly (Fig. 3D).

**Metasoma.** Petiole long, conspicuously longer than width; dorsal surface of petiole with indistinct, median, longitudinal groove (Fig. 3F); lateral surface of petiole with two short, longitudinal carinae (Fig. 3G). Gaster shiny, with sparse, tiny punctures; sternum I with median, longitudinal carina and two longitudinal rugae; sternum II deeply impressed basally; gaster slightly constricted between terga I and II (Fig. 3G); pygidial plate lacking.

**Male.** Unknown.

**Distribution.** China (Tibet).

**Etymology.** The name *edentatus* is derived from the prefix *e-* (= without) and the Latin word *dentatus* (= dentate), referring to the hypersternaulus smooth, not crenate.

### *Passaloecus margdentatus* Li & Ma, sp. nov.

<https://zoobank.org/63C7B755-BA33-4305-94EE-CD715B93EC7B>

Figs 4A–G

**Type material. Holotype:** CHINA • ♀; Yunnan, Shangri-La City, Jiantang Town, Lindu Village; 27°47'24"N, 99°48'36"E; 3321 m elev.; 13.VII.2022; coll. Huifen Jiang; Yellow Plates (YNAU). **Paratype:** CHINA • 1♀; Yunnan, Shangri-La City, Jiantang Town, East Ring Road; 27°50'24"N, 99°46'48"E; 3373 m elev.; 14.VII.2022; coll. Lili Dong; sweep net (YNAU).

**Diagnosis.** This species is distinguished from *P. tuberangustus* Bashir & Ma, 2019 and other congeners by the following characteristics: in female, free margin of clypeus

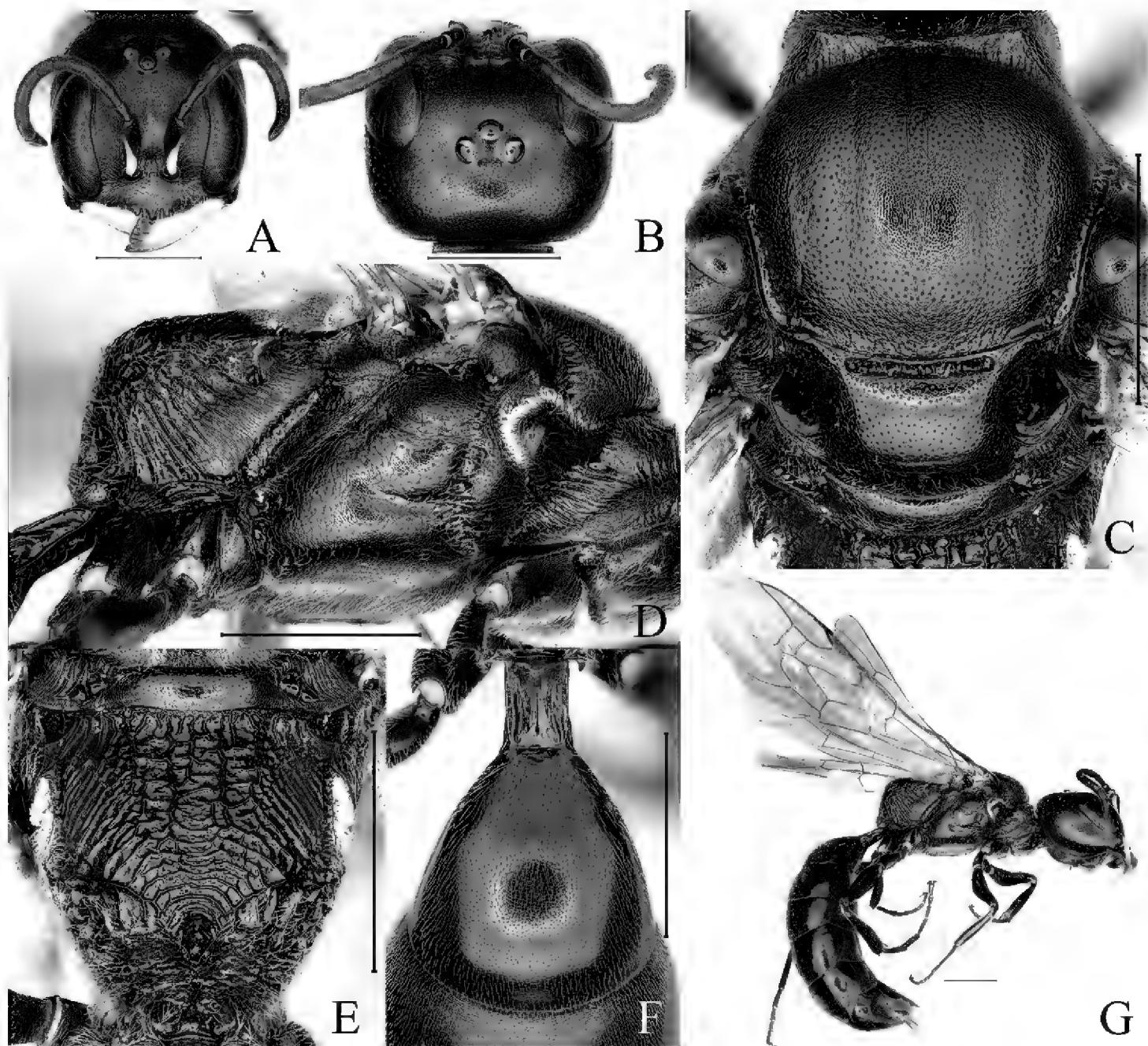
with 3 distinct teeth; hypersternaulus smooth, not crenate; anterior margin of pronotal collar with slender, transverse carina; propodeal enclosure with irregular rugae medially, and sparse, irregular, oblique rugae laterally; pronotal lobe black. *Passaloecus tuberangustus* has the following characters: in female, free margin of clypeus with shallow emargination medially, in male, free margin of clypeus truncate; hypersternaulus distinctly crenate; pronotal collar without anterior, transverse carina; propodeal enclosure with dense, slender, longitudinal rugae, and interspersed with several, short, transverse rugae medially; pronotal lobe ivory.

**Description. Female. Measurements.** ♀, BL: 8.5 mm; HLF: HW: HLD = 77: 85: 42; HW: EWD: EW: TW: EL = 85: 20: 25: 50: 58; POD: OOD: OCD = 9: 12: 26; SL: PL: LFI: LFII: WFI: WFII = 35: 7: 11: 10: 6: 7; WAS: AOD: IAD = 6: 7: 7; EDU: EDL = 38: 37; PLL: PW: LTI: WTI = 20: 13: 52: 55.

**Color pattern.** Body black; mandible ivory except apex reddish-brown; margin of labrum ivory, central part brown; palpi brown to reddish-brown; scape ventrally ivory; tegula and forewing veins dark brown; fore leg: femur reddish-brown basally, tibia and tarsus yellowish-brown to dark brown; mid and hind tibiae and tarsi dark brown; sides of lower frons and clypeus with scattered, silvery, short setae; outer margin of mandible with scattered, golden, long setae.

**Head.** Mandible with two blunt teeth apically, inner tooth large (Fig. 4A). Labrum broad V-shaped, apex thickened, weakly constricted subapically (Fig. 4A). Clypeus coriaceous, nearly flat, with several, fine punctures basally; free margin of clypeus slightly produced, with three distinct teeth medially, all teeth moderately upturned, median tooth large, area between teeth deeply emarginated (Fig. 4A). Sides of lower frons coarsely coriaceous; scapal hollow shiny, coriaceous, shallow, clearly defined; interantennal tubercle narrow and short; frontal median carina very weakly impressed; median and upper frons coarsely coriaceous, slightly convex, with dense, midsize punctures (Fig. 4A). Ocellar triangle coriaceous, moderately convex, with sparse, fine to midsize punctures (Fig. 4B). Occipital carina narrow, not crenate (Fig. 4B). Inner and outer orbital furrows lacking (Fig. 4A).

**Mesosoma.** Anterior margin of pronotal collar with weak, transverse carina, antero-lateral corner absent (Fig. 4C). Scutum coarsely coriaceous, with dense, fine to midsize punctures, anterior area nearly right angle, significantly higher than pronotum; scutal patches absent; admedian line distinct, weakly impressed, extending to 2/5 of scutum length; notaulus distinct, weakly impressed, extending to 1/3 of scutum length; parapsidal line distinctly impressed, long (Fig. 4C). Scutellum shiny, with dense, fine to midsize punctures (Fig. 4C). Metanotum shiny, with sparse, tiny punctures (Fig. 4C). Mesopleuron coriaceous, with sparse, fine to midsize punctures, posterior area smooth, without rugae; scrobal suture broad, shallowly impressed and weakly crenate; episternal sulcus broad, deeply impressed and conspicuously crenate; hypersternaulus with broad, deeply impressed, smooth, not crenate; omaulus absent (Fig. 4D). Metapleuron shiny, coarsely coriaceous (Fig. 4D). Propodeal enclosure matte, not delimited by carina, with irregular rugae medially, and sparse, irregular, oblique rugae laterally; posterior surface of propodeum coarsely coriaceous, with median, longitudinal rugae and



**Figure 4.** *Passaloecus margidentatus* Li & Ma, sp. nov. (female) **A** head, frontal view **B** head, dorsal view **C** collar, scutum, scutellum and metanotum, dorsal view **D** thorax, lateral view **E** propodeum, dorsal view **F** petiole and tergum I dorsal view **G** habitus, lateral view. Scale bars: 1 mm.

several, irregular, transverse rugae (Fig. 4E); lateral surface of propodeum with dense, slender, oblique rugae, anteriorly, and with sturdy oblique rugae posteriorly (Fig. 4D).

**Metasoma.** Petiole long, conspicuously longer than width (Fig. 4F); dorsal surface with conspicuous median, longitudinal groove (Fig. 4F); lateral surface of petiole with two sturdy, longitudinal, carinae (Fig. 4G). Gaster shiny, impunctate; sternum I with distinct, median, longitudinal carina and several, short, longitudinal rugae; sternum II shallowly impressed basally; gaster distinctly constricted between terga I and II (Fig. 4G); pygidial plate lacking.

**Male.** Unknown.

**Distribution.** China (Yunnan).

**Etymology.** The name *margidentatus* is derived from the Latin *marg-* (= margin), and the Latin word *dentatus* (= dental), referring to the free margin of clypeus with three distinct teeth medially.

***Passaloecus sternoleios* Li & Ma, sp. nov.**

<https://zoobank.org/DFE6A4EA-0E4A-48C6-AD7A-AE2D6C87DE65>

Figs 5A–H

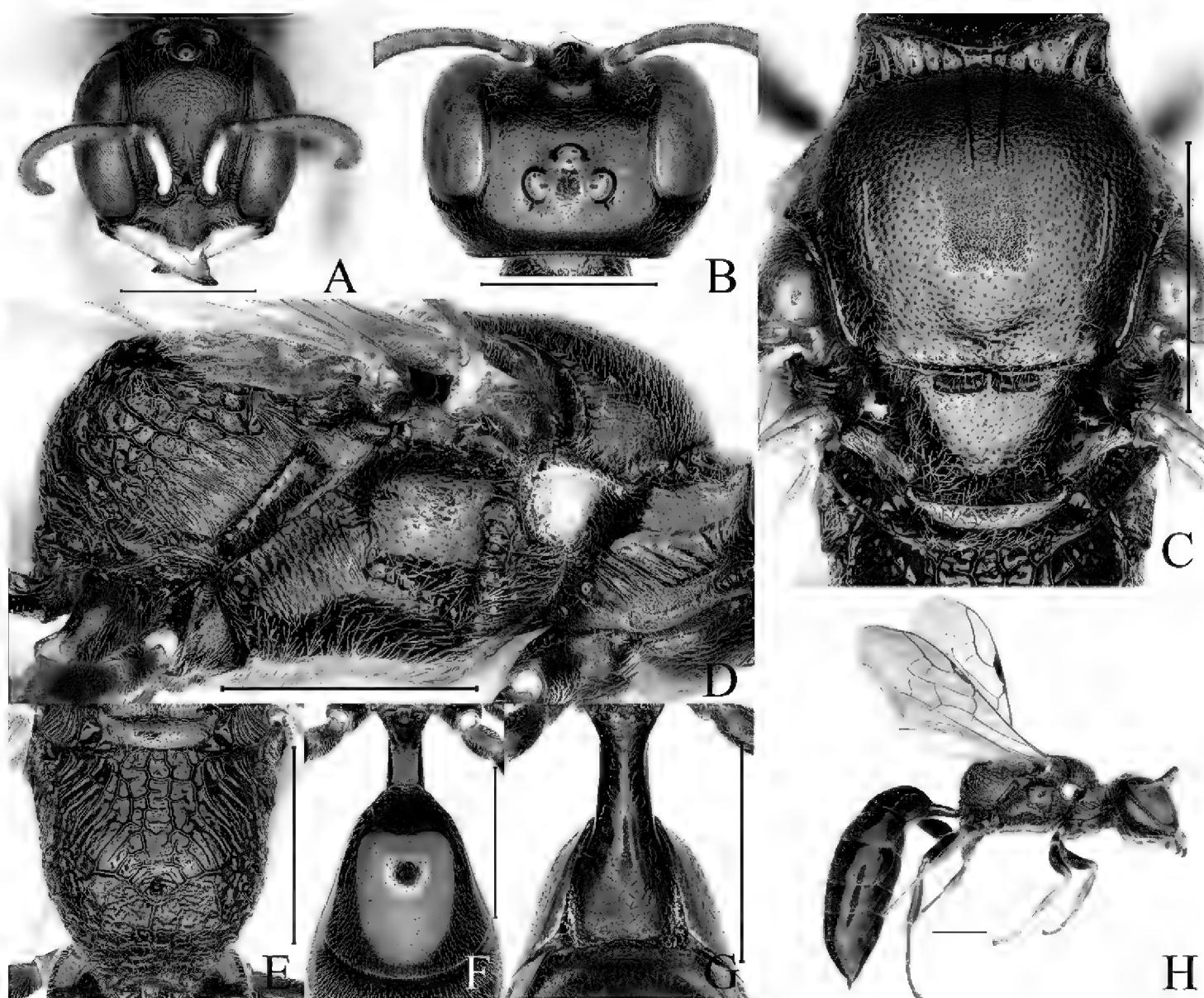
**Type material.** **Holotype:** CHINA • ♀; Guangdong, Qingyuan City, Fogang County, Guanyin Mountain; 23°58'12"N, 113°33'49"E; 353 m elev.; 15–16.IX.2007; Yellow Plates (YNAU). **Paratype:** CHINA • 1♀; Guangdong, Shaoguan City, Nanling National Nature Reserve; 24°54'49"N, 113°2'30"E; 845 m elev.; 23.V.2020; coll. Fei Ye; flight intercept traps (YNAU).

**Diagnosis.** This species differs from *P. insignis* (Vander Linden, 1829) and other congeners by these characteristics: petiole conspicuously longer than width; inner and outer orbital furrows broad, marginal carina conspicuous, outer orbital furrow distinctly crenate; occipital carina broad, conspicuous crenate; notaulus lacking; sternum I smooth, without carina and rugae. *Passaloecus insignis* has the following characters: petiole not longer than width; inner and outer orbital furrows lacking; occipital narrow, not crenate; notaulus shallowly impressed, crenate; sternum I with sturdy, median, longitudinal carina and several, short, longitudinal rugae.

**Description. Female. Measurements.** ♀, BL: 7.8 mm; HLF: HW: HLD = 73: 78: 30; HW: EWD: EW: TW: EL = 78: 20: 26: 33: 60; POD: OOD: OCD = 10: 13: 16; SL: PL: LFI: LFII: WFI: WFII = 28: 6: 7: 7: 5: 5; WAS: AOD: IAD = 6: 5: 7; EDU: EDL = 42: 32; PLL: PW: LTI: WTI = 25: 10: 40: 52.

**Color pattern.** Body black; mandible ivory except apex yellowish-brown to reddish-brown; central part of labrum with ivory, V-shaped stripe, remainder yellowish-brown; palpi ivory to pale yellow; ventral scape and pronotal lobe ivory; dorsal scape, pedicel, flagellum, tegula, forewing veins yellowish-brown to dark brown; fore leg: apex of trochanter ivory, remainder dark brown, femur dark brown except base and apex yellowish-brown to brown, tibia and tarsus pale yellow to yellowish-brown; mid and hind legs: apex of trochanter, base of femur, ventral tibia and tarsus yellowish-brown, remainder dark brown; sides of lower frons and clypeus with scattered, silvery, short setae; clypeus with sparse, golden, short setae, and interspersed with several golden, long setae apically; labrum with several, golden, long setae apically.

**Head.** Mandible bidentate apically, inner tooth large (Fig. 5A). Labrum slightly narrower than clypeal lobe, heart-shaped, distinctly constricted subapically (Fig. 5A). Clypeus slightly convex medially, coriaceous; free margin of clypeus broadly produced, semicircular (Fig. 5A). Sides of lower frons coarsely coriaceous, and with irregular, longitudinal rugae; scapal hollow coriaceous, shiny, slightly deep, clearly defined; interantennal tubercle narrow and short; median and upper frons coarsely coriaceous, with sparse, irregular, transverse rugae, frontal median carina strong, extending to anterior ocellus (Fig. 5A). Ocellar triangle shiny, moderately convex, with sparse, fine to midsize punctures (Fig. 5B). Vertex shiny, with sparse, fine punctures (Fig. 5B). Gena shiny, coriaceous, with sparse, indistinct, midsize punctures. Occipital carina broad, conspicuously crenate (Fig. 5B). Inner orbital furrow broad, smooth, shiny, boundary carina distinct (Fig. 5A); outer orbital furrow broad, distinctly crenate, boundary carina distinct (Fig. 5H).



**Figure 5.** *Passaloecus sternoleios* Li & Ma, sp. nov. (female) **A** head, frontal view **B** head, dorsal view **C** collar, scutum, scutellum and metanotum, dorsal view **D** thorax, lateral view **E** propodeum, dorsal view **F** petiole and tergum I dorsal view **G** petiole and sternum I ventral view **H** habitus, lateral view. Scale bars: 1 mm.

**Mesosoma.** Anterior margin of pronotal collar with strong, arcuate, transverse carina, antero-lateral corner markedly produced (Fig. 5C). Scutum coarsely coriaceous, with dense, fine to midsize punctures, posterior area with several, indistinct, very short, longitudinal rugae; scutal patches absent; admedian line robust, distinctly raised, extending to 1/3 of scutum length; notaulus lacking; parapsidal line distinctly impressed, slightly shorter than admedian line (Fig. 5C). Scutellum shiny, with dense, fine punctures (Fig. 5C). Metanotum smooth and shiny (Fig. 5C). Mesopleuron shiny, with scattered fine punctures, posterior area with contiguous, short, longitudinal rugae; scrobal suture lacking; hypersternaulus and episternal sulcus broad, conspicuously crenate; omaulus absent (Fig. 5D). Metapleuron shiny and smooth (Fig. 5D). Propodeal enclosure shiny, not delimited by carina, with sturdy, irregular rugae medially, and sparse, sturdy, oblique rugae laterally; posterior surface of propodeum reticulated (Fig. 5E); lateral surface of propodeum with dense, slender, oblique rugae anteriorly, and irregular reticulation posteriorly (Fig. 5D).

**Metasoma.** Petiole long, conspicuously longer than width, smooth, without carina or rugae (Fig. 5F). Gaster shiny, and with sparse, tiny punctures; sternum I smooth and shiny, without carina or rugae (Fig. 5G); sternum II deeply impressed basally (Fig. 5G); gaster slightly constricted between terga I and II (Fig. 5H); pygidial plate lacking.

**Male.** Unknown.

**Distribution.** China (Guangdong).

**Etymology.** The name *sternoleios* is derived from the Greek *stern-* (= sternum), and the Greek word *leios* (= smooth), referring to the sternum I smooth and shiny, without carina or rugae.

## Discussion

The genus *Passaloecus* comprises 46 species and 5 subspecies globally, primarily distributed across the Palearctic, Nearctic, and Oriental regions. China boasts the highest diversity of this genus, with 18 species and 1 subspecies recorded across its Provinces (Ma and Li 2012; Bashir et al. 2021; Pulawski 2024). Furthermore, the identification of 5 new species in this study enhances the existing species records in China, indicating that many more undiscovered species likely exist in regions that remain insufficiently explored. This significant diversity is closely associated with China's unique geographical position, which spans both the Palearctic and Oriental regions. It reflects a rich ecosystem and diverse climatic conditions that provide favorable environments for the survival and reproduction of *Passaloecus* (Fan et al. 2024).

Notably, all 13 known species and one subspecies of *Passaloecus* in the Oriental region are exclusively distributed in China, with no records found in other Oriental countries, such as those in Southeast Asia (Bashir et al. 2023). However, the climate of China's Oriental region closely resembles that of neighboring Southeast Asian countries, both classified as subtropical and tropical climate types, and there are no significant geographical barriers separating them (Yang et al. 2020; Meng and Song 2023). Consequently, it can be inferred that the *Passaloecus* genus may also be present in Southeast Asia.

From a global perspective, further collection and research efforts are essential. Although only one species of the *Passaloecus* genus is currently recorded in the Neotropical region, the climatic conditions there are highly conducive to species diversification, suggesting the potential existence of additional undiscovered species (Amarante and Vincent 1993; Vardy 2017). Furthermore, there are currently no distribution records for this genus in the Afrotropical and Australian regions, which may be attributed to a combination of factors, including climatic conditions, historical geographical isolation, and ecological competition (Machac 2023). Additionally, the inadequacy of collection efforts and research may hinder the accuracy of current species records. Increased investigations in these regions could lead to the discovery of new distributions of this genus, which is crucial for understanding the global diversity of *Passaloecus*.

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